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EXAMINER

KAO, CHIH CHENG G

ART UNIT	PAPER NUMBER
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2882

DATE MAILED: 02/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/681,186

Applicant(s)

SCHNEIDER ET AL.

Examiner

Chih-Cheng Glen Kao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 October 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 April 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. 6) ☐ Other: _____

DETAILED ACTION

Drawings

1. The drawings received on 4/21/03 are acknowledged and accepted.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. (US Patent 5222113) in view of Iketaki (US Patent 5450463), Levine et al. (Tomographic reconstruction of an integrated circuit interconnect), and Sartore (US Patent 5703361).

3. With regards to claims 1 and 12, Thieme et al. discloses a method and x-ray microscope (Title) for examining a structure having a thickness (Fig. 1, #4) comprising penetrating and imaging with x-rays (Fig 1) with an objective (col. 1, lines 40-45, and col. 3, lines 40-45).

However, Thieme et al. does not disclose establishing a wavelength or range as a function of the thickness of the sample for imaging on a spatially resolving detector to observe changes by contrast or examining passivated structures on a semiconductor substrate.

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Iketaki teaches establishing a wavelength or range as a function of the thickness of the sample (col. 2, lines 49-55, and col. 21, lines 40-55) for imaging on a spatially resolving detector (Fig. 11, #57) to observe changes by contrast (Abstract). Levine et al. teaches examining structures on a semiconductor substrate (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2). Sartore shows examining passivated integrated circuits (Title Page, Other Publications).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the method and device of Thieme with establishing a wavelength or range as a function of the thickness of Iketaki, since one would be motivated to increase quality or contrast of an image as implied from Iketaki (col. 2, lines 34-40).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the method and device of Thieme with examining structures on a semiconductor substrate of Levine et al., since one would be motivated to incorporate this to provide inspection (Page 150, col. 1, first paragraph) as implied from Levine et al.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the method and device of Thieme with examining of passivated integrated circuits of Levine et al., since one would be motivated to incorporate this to provide defect inspection and thickness mapping (Title Page, Other Publication) as implied from Sartore.

4. With regards to claim 2, Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose reducing the thickness of a substrate to examine metal structures.

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Levine et al. teaches reducing the thickness of a substrate (Abstract, lines 1-2) to examine metal structures (Page 150, col. 2, lines 1-2).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with thickness reduction, since one would be motivated to image just the important features of a structure as implied from Levine et al. (Page 150, col. 1, last line, and col. 2, lines 1-11).

5. With regards to claim 3, Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose the substrate made of silicon having less than 30um thickness and x-radiation wavelength between 0.1 to 2nm.

Levine et al. teaches the substrate made of silicon (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2) having less than 30um thickness (Abstract, lines 1-2) and x-ray wavelength between 0.1 and 2nm (Page 150, col. 2, line 15).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with a substrate made of silicon, since it would have been within general skill of a worker in the art to select a known material on the basis of its suitability. One would be motivated to have silicon for a substrate, since silicon has long been recognized as a preferred substrate material.

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It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with thickness less than 30um, since one would be motivated to image just the important features of a structure as implied from Levine et al. (Page 150, col. 1, last line, and col. 2, lines 1-11). Note that wherein the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with wavelengths between 0.1 to 2 nm, since one would be motivated to use these wavelengths to get an image (Page 150, col. 2, second paragraph) as implied from Levine et al. Note that wherein the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art.

6. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Iketaki, Levine et al., and Sartore as applied to claim 1 above, and further in view of Schneider (Dissertation).

7. With regards to claim 4, Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose wavelength selected by Rayleigh-Gans algorithms for scattering.

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Schneider teaches wavelength selected by Rayleigh-Gans algorithms for scattering (Page 1, lines 8-14).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with the wavelength selected by Rayleigh-Gans algorithms for scattering of Schneider, since one would be motivated to use this phase information derived from Rayleigh-Gans algorithms to operate at even shorter wavelengths as implied from Schneider (Page 2, lines 4-6), which is advantageous for viewing even smaller structures.

8. With regards to claim 5, Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose metal structures on a substrate nor wavelengths based on absorption discontinuities.

Levine et al. teaches metal structures on a substrate (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2). Schneider teaches wavelength based on absorption discontinuities (Page 2, lines 1-4).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with the metal structures, since it would have been within general skill of a worker in the art to select a known material on the basis of its suitability. One would be motivated to use have metal structures to use as connections or wires to connect components in a

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semiconductor device as implied from Levine et al. (Page 150, col. 1, last 4 lines, to col. 2, lines 1-2).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with wavelength based on absorption discontinuities of Schneider, since one would be motivated to use the absorption discontinuities or windows to obtain good amplitude contrast as implied from Schneider (Page 2, lines 1-4) for a better image.

9. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Iketaki, Levine et al., and Sartore as applied to claim 1 above, and further in view of Oka et al. (JP 02-203261).

Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose x-rays impinging on the substrate at a side containing no structures.

Oka et al. further teaches x-rays impinging on the substrate at a side containing no structures (Fig. 1b).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with x-rays impinging on at a side containing no structures of Oka et al., since one would be motivated to impinge the side with no structures to image the structures within a package (Fig. 1b) as implied from Oka et al.

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10. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Iketaki, Levine et al., and Sartore as applied to claim 1 above, and further in view of Wilkins (US Patent 6163590).

Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose imaging at different angles to allow stereographic and tomographic reconstruction.

Levine et al. teaches imaging at different angles (Abstract) to allow tomographic reconstruction (Title). Wilkins teaches imaging at different angles to allow stereographic reconstruction (col. 11, lines 17-27).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with tomographic reconstruction, since one would be motivated to image in 3 dimensions as implied from Levine et al. (Page 150, col. 1, lines 1-3), which will reveal more information than a two-dimensional image.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with stereographic reconstruction of Wilkins, since one would be motivated to image in 3 dimensions as implied from Wilkins (col. 11, lines 17-27), which will reveal more information than a two-dimensional image.

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11. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Iketaki, Levine et al., and Sartore as applied to claim 1 above, and further in view of Schmahl et al. (Proposal for a Phase Contrast Microscope).

Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method as recited above.

However, Thieme et al. does not disclose operating in phase contrast to provide minimal exposure.

Schmahl et al. teaches operating in phase contrast to provide minimal exposure (Page 237, col. 2, lines 1-5).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with phase contrast of Schmahl et al., since one would be motivated to use it for minimal exposure (Page 237, col. 2, lines 1-5).

12. Claims 9, 10, 13, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Iketaki, Levine et al., and Sartore as applied to claim 1 and 12 above, and further in view of Schmahl et al. and Nagai et al. (US Patent 5434901).

13. With regards to claims 9 and 13, Thieme et al. in view of Iketaki, Levine et al., and Sartore suggests a method and device as recited above.

However, Thieme et al. does not disclose a segmented phase plate in a back focal plane of the objective.

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Schmahl et al. teaches a phase plate in a back focal plane of the objective (Fig. 16.1).

Nagai et al. teaches a segmented phase plate (Fig. 4, #37a and 37b).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method and device of Thieme et al. in view of Iketaki, Levine et al., and Sartore with the phase plate in the back focal plane of Schmahl et al., since one would be motivated use it for amplifying the image (Page 233, lines 1-2) as implied from Schmahl et al.

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have with the suggested method of Thieme et al. in view of Iketaki, Levine et al., and Sartore with the segmented phase plate of Nagai et al., since one would be motivated use it for better viewing low contrast objects (col. 9, lines 34-41) as implied from Nagai et al. ('901).

14. With regards to claims 10 and 14, Thieme et al. in view of Iketaki, Levine et al., and Sartore, Schmahl et al., and Nagai et al. suggests a method and device as recited above.

However, Thieme et al. does not disclose a segmented stop before a condenser.

Nagai et al. teaches a segmented stop before the condenser (Fig. 3B, #22b and 22).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method and device of Thieme et al. in view of Iketaki, Levine et al., and Sartore, Schmahl et al., Nagai et al. with the segmented stop before the condenser, since one would be motivated to have a stop before the condenser to control or isolate

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light (Fig. 3B) as implied from Nagai et al. ('901) into the condenser, which creates less interference in the signal.

15. Claims 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thieme et al. in view of Iketaki, Levine et al., and Sartore, Schmahl et al., Nagai et al. as applied to claims 10 and 14 above, and further in view of Schmal et al. (US Patent 5550887).

Thieme et al. in view of Iketaki, Levine et al., and Sartore, Schmahl et al., Nagai et al. suggests a method and device as recited above.

However, Thieme et al. does not disclose a segmented annular condenser zone plate used as a condenser.

Schmal et al. teaches a segmented annular zone plate as the condenser (col. 2, lines 45-50).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to have the suggested method and device of Thieme et al. in view of Iketaki, Levine et al., and Sartore, Schmahl et al., Nagai et al. with the zone plate of Schmal et al., since one would be motivated to use it to focus the x-ray radiation on the sample (col. 2, lines 44-46) as implied from Schmal et al.

Response to Arguments

16. Applicant's arguments with respect to claims 1-15 have been considered but are moot in view of the new ground(s) of rejection.

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17. Applicant's arguments filed 10/14/03 have been fully considered but they are not persuasive.

The following are remarks with regards to Applicants' concerns of a reasonable expectation of success with the combination of at least Thieme, Iketaki, and Levine et al. With regards to Iketaki, the reference is cited to show that it is known in the art to adjust wavelengths based on the thickness of the object to be inspected. Since biological specimens and semi-conducting devices are both objects that are known in the art to be inspected under x-ray microscopes, it would have been within one of ordinary skill in the art to substitute one type of object of inspection for another. If one substitutes different items to be inspected, it would have also been within ordinary skill in the art to accordingly adjust the wavelengths based on the objects parameters, such as parameters cited by Levine et al. With regards to Iketaki and zone plates, zone plates are considered with the microscope of Iketaki (col. 16, lines 10-17). Based on the above teachings, it is the position of the examiner that there exists a reasonable expectation of success in combination with these references.

With regards to claim 12, the claim covers just the x-ray microscope itself. As claimed, it does not matter whether the specimen is an integrated circuit or a biological specimen. The intended use of the claimed invention does not result in a structural difference between the claimed invention and the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. In order to incorporate the semiconductor substrate and passivated structures, the claim will need to be amended to a system for examining structures ... comprising: an imaging x-ray microscope comprising: a chamber... an objective... and an x-radiation source....

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Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (571) 272-2492. The examiner can normally be reached on M - F (9 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



gk



EDWARD J. GLICK
SUPERVISORY PATENT EXAMINER